

Internetworking Cisco Routers

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LAB 1

IOS Commands

In this lab, we will:

- Demonstrate the command syntax available in user and enable mode
- Use and understand common IOS commands used to display router status
- Examine and change a router configuration file

Overview of steps

You will use HyperTerminal terminal emulator to communicate with the router via its console port.

Equipment

Windows NT 4.0 server and terminal emulator
Pre-configured Cisco router

Complete the following using these commands:

show version	login
show interface	configure terminal
show protocol	hostname
show ip protocol	exit
show startup-config	end
show running-config	copy
show flash	?

- 1) What is your router name? _____
- 2) What version of IOS is running on your router? _____
- 3) What version of Bootstrap ROM is in your router? _____
- 4) What kind of Cisco router are you using? _____
- 5) How much main memory is installed in your router? _____
- 6) How much flash memory is installed in your router? _____
- 7) How much non-volatile memory does your router have for storing configuration files? _____
- 8) What is the value of your config register? _____
- 9) What routing protocols are enabled on your _____

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router?

10) Complete the following table:

Name of interfaces installed on your router	enabled or disabled	IP address	Subnet Mask	MAC address

11) How many different IP networks does your router know how to reach?

12) What IP routing protocol is your router using?

13) What IP networks is your router advertising?

14) How many other routers has your router heard EIGRP updates from?

Now enter enable mode by typing in the command "**enable**". When prompted for the password, type "**password**" then press <Enter>. If successful, your prompt should change from xxx> to xxx# , where xxx is your router name.

15) View the running configuration.

Type:

"show running-config"

16) View the startup configuration.

Type:

"show startup-config"

17) Are there any major differences?

18) Why/why not?

19) Let's change our hostname and observe the results.

Type:

"configure terminal"

"hostname yourlastname"

"exit"

Note that your prompt should have changed to yourlastname#

20) View the running configuration.

Type:

"sho run"

21) View the startup configuration.

Type:

"show start"

22) Note the value of the variable hostname.

23) Are they the same? _____

24) Why/why not? _____

25) Save your configuration to NVRAM.

Type:

"copy running-config startup-config"

26) Is the value of variable hostname the same now? _____

27) View the contents of the flash memory.

Type:

"sho flash"

28) How many IOS files are present in the flash memory? _____

29) What is the name of the IOS files in flash? _____

30) What is the length of the IOS files in flash? _____

- Ensure you have connectivity to your workstation by using the ping command.
- Start the TFTP server software on your workstation by double clicking on the Cisco TFTP Server icon on your desktop.

31) Save your startup-config to your workstation.

Type:

"copy startup-config tftp"

Remote host [xxx.xxx.xxx.xxx] ? (Enter the IP address of your workstation)

Name of configuration file to write [startup-config] ? Yourroutername .txt

[Confirm] <Enter>

You can use WordPad to view and edit your backup configuration file from the directory C:\Program Files\Cisco Systems\Cisco TFTP Server\

LAB 2

Interface Configuration and Testing

In this lab, we will:

- Configure interfaces on your router.
- You will familiarize yourself with accessing your router using TELNET application and use Cisco commands and utilities to debug the network.

Overview of steps

You will first configure your router using the IP address spread sheet. Then you will use the Telnet application to connect to your router via your Ethernet network.

Equipment

Windows NT 4.0 server and terminal emulator
Un-configured Cisco router

Complete the following using these commands:

Hostname	ip address
Interface	media-type
Description	clock rate
clock rate	show ip interface brief
Password	banner
Service	show log

Connect to your router using HyperTerminal.

- 1) Set the hostname for your router using the IP spread sheet and network diagram.

Type:

"en"

"conf t"

"hostname [name of router]"

"end"

- 2) Configure a warning banner.

Type:

"conf t"

"banner motd c [type or past the contents of the warn.txt file from your desktop] **c"** (Where "c" is a delimiting character)

"end"

- 3) Set the console password.

Type:

"config t"

"line con 0"

"login"

"password [any clear text password]" Make the password "password".

*******The password is case sensitive, so be careful.*******

"end"

- 4) Set the virtual line password.

Type:

"config t"

"line vty 0 4"

"login"

"password [any clear text password]" Make the password "password".

*******The password is case sensitive, so be careful.*******

"end"

- 5) Set the enable password.

Type:

"config t"

"enable password [any clear text password]" Make the password

"password".

*******The password is case sensitive, so be careful.*******

"end"

- 6) Set the enable secret password.

Type:

"config t"

"enable secret [any clear text password]" Make the password "password".

*******The password is case sensitive, so be careful.*******

"end"

- 7) Set the logging buffer size.

Type:

"conf t"

"logging buffered 4096"

"end"

- 8) View the log file to see event information.

Type:

"show log"

- 9) Configure the Ethernet interface connected to your hub.

Type:

"en"

"conf t"

"interface ethernet 0" (some routers are using "int fastEthernet 0/0")

"description [i.e. lan connection to LANT FSSG]"

"ip address xxx.xxx.xxx.xxx yyy.yyy.yyy.yyy"

(xxx = IP address, yyy = subnet mask)

"media-type 10baseT" (only if interface has both AUI and RJ45)

"no shutdown"

"end"

- 10) Connect serial interfaces per network diagram.

- 11) Configure the 1st serial interface on your router.

Type:

"sho controllers s0" (some routers are using s0/0)

******To determine if the serial cable connected to your router is DCE or DTE******

"conf t"

"int s0"

"description [i.e. 56Kbps wan connectipin to MARFORLANT]"

"clock rate 56000" (only if DCE cable)

"ip address xxx.xxx.xxx.xxx yyy.yyy.yyy.yyy"

"no shut"

"end"

- 12) Configure the debug and log messages to display the date and time.

Type:

"conf t"

"service timestamps debug datetime"

"service timestamps log datetime"

"end"

- 13) Unplug the Ethernet cable from your router then re-insert it.

- 14) View the log file to see the results.

- 15) Configure additional serial interfaces as needed.

- 16) Verify the operational status of your interfaces.

Type:

"sho ip interface brief"

*****all configured interfaces should be up/up*****

*****Do not proceed until they are operational*****

17)Can you ping your directly connected neighbor's router? _____

18)Can you ping all interfaces on your directly connected neighbor's router? _____

19)Why/why not? _____

20)Telnet to the router from your workstation.

From the command prompt on your workstation Type:

"telnet [ip address of the ethernet interface on your router]"

Enter the console password **"password"**

21)Encrypt your passwords.

Type:

"conf t"

"service password-encryption"

"end"

22)Save your configuration.

LAB 3

Cisco Discovery Protocol (CDP)

In this lab, we will:

- Demonstrate the command syntax available to utilize CDP
- Gather information about neighboring routers

Overview of steps

You will use Cisco's layer 2 protocol to troubleshoot and discover your network.

Equipment

Windows NT 4.0 server and terminal emulator

Pre-configured Cisco router

Complete the following using these commands:

no cdp run	show cdp
cdp run	show cdp interface
cdp enable	show cdp neighbor
no cdp enable	show cdp neighbor detail

- 1) How many neighbors do you have? _____
- 2) What are there names? _____
- 3) What model router is a neighbor of int S0? _____
- 4) What is the IP address of the router on int S0? _____
- 5) What version of IOS is the router on int S0 running? _____
- 6) How often is CDP currently sending out updates? _____
- 7) Turn off CDP on the router.
Type:
"conf t"
"no cdp run"
"end"
- 8) How many neighbors do you have now? _____
- 9) Why would you want to turn off CDP? _____
- 10) Re-enable CDP

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Type:
"conf t"
"cdp run"
"end"

11) Turn CDP off on your Ethernet interface.

Type:
"conf t"
"int e0"
"no cdp enable"
"end"

12) How many neighbors do you have now?

13) Why would you want to turn off CDP on one interface?

LAB 4

Static Routes

In this lab, we will:

- Program static routes into a Cisco router and test to see if the routes work as expected.
- Use Cisco commands and utilities to debug the network.

Overview of steps

You will first verify that your router is configured properly according to the IP spread sheet. Then work with your neighboring team to enter static routes into your router and verify that they work.

Equipment

Windows NT 4.0 server and terminal emulator

Cisco router

Complete the following using these commands:

show ip route	ping
show ip int brief	ip route
show start	

- 1) How many IP networks does my router know how to reach? _____
- 2) What command did you use? _____
- 3) What IP addresses are assigned to your interfaces? _____
- 4) Is there any relation between your interface settings and the networks displayed by "show ip route"? _____
- 5) Why can you not see any other IP routes? _____
- 6) Enter the IOS command to ping your E0 and S0 interfaces. _____
- 7) Are your router interfaces operational? _____
- 8) From a DOS prompt ping your E0 interface. _____
- 9) Did it work? _____
- 10) From a DOS prompt ping your S0 interface. _____
- 11) Did it work? _____
- 12) From a DOS prompt ping your neighbor routers E0 interface. _____
- 13) Did it work? _____

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******Stop here and check with your neighbor. All remaining steps must be performed by both ends prior to testing your configuration.******

14) Configure a static route to your neighbor routers Ethernet network.

Type:

"conf t"

"ip route xxx.xxx.xxx.xxx yyy.yyy.yyy.yyy zzz.zzz.zzz.zzz"

(xxx = IP network, yyy = subnet mask, zzz = next-hop)

"end"

15) From a DOS prompt ping your neighbor routers E0 interface.

16) Did it work? _____

17) Is the static route you just entered in the
NVRAM configuration file? _____

18) Save your configuration. _____

19) How many IP networks does your router know
how to reach now? _____

20) What type of routes are in your routing table? _____

21) Configure static routes to all other networks in the classroom.

22) Test your configuration by pinging all devices on the network.

This Lab is complete when all clients and routers
can ping all other clients and routers.

LAB 5

Default Route

In this lab, we will:

- Program a default route into a Cisco router and test to see if the routes work as expected.
- Use Cisco commands and utilities to debug the network.

Overview of steps

You will first remove all static routes except the route(s) to your child router(s). Then enter a default route to your parent router and verify that it works.

Equipment

Windows NT 4.0 server and terminal emulator

Cisco router

Complete the following using these commands:

show ip route	ping
show start	ip route

- 1) Remove all static routes except the route(s) to your child router(s).
- 2) Configure a default route to your parent router.

Type:

"conf t"

"ip route 0.0.0.0 0.0.0.0 zzz.zzz.zzz.zzz"

(0.0.0.0 = any IP network, 0.0.0.0 = any subnet mask, zzz = next-hop)

"end"

- 3) How many IP networks does my router know how to reach? _____
- 4) Is the default route you just entered in the NVRAM configuration file? _____
- 5) Save your configuration. _____
- 6) What type of routes are in your routing table? _____
- 7) Test your configuration by pinging all devices on the network.

This Lab is complete when all clients and routers can ping all other clients and routers.

LAB 6.1

Routing Protocols (RIP)

In this lab, we will:

- Configure your router to participate in RIP message exchanges.
- Verify reach ability to other networks and devices in the classroom.

Overview of steps

You will use the terminal emulator to communicate with the router via the console port.

Equipment

Windows NT 4.0 server and terminal emulator

Cisco router

Complete the following using these commands:

sho ip route	router rip
network	sho ip prot

- 1) Remove all static and default routes.

You must tell RIP what networks to advertise when it sends routing updates.

- 2) What networks will your router advertise? _____

- 3) Configure RIP on your router.

Type:

"conf t"

"router rip"

"network xxx.xxx.xxx.xxx" (Directly connected IP network to advertise)

"network xxx.xxx.xxx.xxx" (Directly connected IP network to advertise)

"end"

- 4) Save your configuration.

- 5) Type the command **"sho ip protocol"**.

- 6) What routing protocol are you running? _____

- 7) How often is RIP sending out updates? _____

- 8) Verify that your router has found a route to every network in the classroom.

- 9) How many RIP routes are in your routing table? _____

- 10) How many hops is the 192.168.21.32 subnet from your router? _____

LAB 6.2

Routing Protocols (IGRP)

In this lab, we will:

- Configure your router to participate in IGRP message exchanges.
- Verify reach ability to other networks and devices in the classroom.

Overview of steps

You will use the terminal emulator to communicate with the router via the console port.

Equipment

Windows NT 4.0 server and terminal emulator

Cisco router

Complete the following using these commands:

sho ip route

router igrp

sho ip prot

network

- 1) Remove RIP.

You must tell IGRP what networks to advertise when it sends routing updates.

- 2) What networks will your router advertise? _____

- 3) Configure IGRP on your router.

Type:

"conf t"

"router igrp 5"

"network xxx.xxx.xxx.xxx" (Directly connected IP network to advertise)

"network xxx.xxx.xxx.xxx" (Directly connected IP network to advertise)

"end"

- 4) Save your configuration.

- 5) Type the command **"sho ip protocol"**.

- 6) What routing protocol are you running? _____

- 7) How often is IGRP sending out updates? _____

- 8) Verify that your router has found a route to every network in the classroom.

- 9) What is the next hop to the 192.168.21.32 subnet? _____

- 10) How many IGRP routes are in your routing table? _____

LAB 6.3

Routing Protocols (EIGRP)

In this lab, we will:

- Configure your router to participate in EIGRP message exchanges.
- Verify reach ability to other networks and devices in the classroom.

Overview of steps

You will use the terminal emulator to communicate with the router via the console port.

Equipment

Windows NT 4.0 server and terminal emulator

Cisco router

Complete the following using these commands:

sho ip route	router eigrp
sho ip prot	network

- 1) Remove IGRP.

You must tell EIGRP what networks to advertise when it sends routing updates.

- 2) What networks will your router advertise? _____

- 3) Configure EIGRP on your router.

Type:

"conf t"

"router eigrp 8"

"network xxx.xxx.xxx.xxx" (Directly connected IP network to advertise)

"network xxx.xxx.xxx.xxx" (Directly connected IP network to advertise)

"end"

- 4) Save your configuration.

- 5) Type the command **"sho ip protocol"**.

- 6) What routing protocol are you running? _____

- 7) How often is EIGRP sending out updates? _____

- 8) Verify that your router has found a route to every network in the classroom.

- 9) What is the next hop to the 192.168.21.32 subnet? _____

- 10) How many EIGRP routes are in your routing table? _____

LAB 6.4

Routing Protocols (OSPF)

In this lab, we will:

- Configure your router to participate in OSPF message exchanges.
- Verify reach ability to other networks and devices in the classroom.

Overview of steps

You will use the terminal emulator to communicate with the router via the console port.

Equipment

Windows NT 4.0 server and terminal emulator
Cisco router

Complete the following using these commands:

sho ip route	router ospf
sho ip prot	network

- 1) Remove EIGRP.

You must tell OSPF what networks to advertise when it sends routing updates.

- 2) What networks will your router advertise? _____

- 3) Configure OSPF on your router.

Type:

"conf t"

"router ospf 6"

"network xxx.xxx.xxx.xxx yyy.yyy.yyy.yyy area 10"

(xxx = IP network, yyy = OSPF wildcard bits)

"network xxx.xxx.xxx.xxx yyy.yyy.yyy.yyy area 10"

"end"

- 4) Save your configuration.

- 5) Type the command **"sho ip protocol"**.

- 6) What routing protocol are you running? _____

- 7) How often is OSPF sending out updates? _____

- 8) Verify that your router has found a route to every network in the classroom.

- 9) What is the next hop to the 192.168.21.32 subnet? _____

- 10) How many OSPF routes are in your routing table? _____

LAB 6.5

Routing Protocols (BGP)

In this lab, we will:

- Configure your router to participate in BGP message exchanges.
- Verify reach ability to other networks and devices in the classroom.

Overview of steps

You will use the terminal emulator to communicate with the router via the console port.

Equipment

Windows NT 4.0 server and terminal emulator

Cisco router

Complete the following using these commands:

sho ip route	router eigrp
sho ip prot	network
router bgp	neighbor

- 1) Remove OSPF.

You must tell EIGRP what networks to advertise when it sends routing updates.

- 2) What networks will your router advertise? _____

- 3) Configure EIGRP on your router.

Type:

"conf t"

"router eigrp [as #]" (ask instructor for as #)

"network xxx.xxx.xxx.xxx" (Directly connected IP network to advertise)

"network xxx.xxx.xxx.xxx" (Directly connected IP network to advertise)

"end"

FSSG, DIV, AND MAW's

- 4) Configure a default route on your router.
- 5) Save your configuration.

MARFORLANT, MARFORPAC, I MEF, II MEF, III MEF, AND MARFORRES

- 6) Configure BGP on your router.

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You must tell BGP what networks to advertise when it sends routing updates.

Type:

"conf t"

"router bgp [as #]" (ask instructor for as #)

"network xxx.xxx.xxx.xxx" (IP network to advertise)

"network xxx.xxx.xxx.xxx" (IP network to advertise)

"network xxx.xxx.xxx.xxx" (IP network to advertise)

"network xxx.xxx.xxx.xxx" (IP network to advertise)

"network xxx.xxx.xxx.xxx" (IP network to advertise)

"neighbor [NOC router serial IP address] remote-as 4066"

"end"

7) Save your configuration.

ALL Students

8) Type the command **"sho ip protocol"**.

9) What routing protocol's are you running?

10) How often is BGP sending out updates?

11) How many BGP routes are in your routing table?

12) Test your configuration by pinging all devices on the network.


```
Type”  
“conf t”  
“no access-list 1”  
“end”
```

- 5) Delete the access control list statement from interface e0.

```
Type:  
“conf t”  
“int e0”  
“no ip access-group 1”  
“end”
```

- 6) Setup an extended access list to permit the use of ping to check IP connectivity from anywhere in the class internet, deny incoming TELNET from outside your region, and permit incoming TELNET connections from your region.

```
Type:  
“conf t”  
“access-list 100 permit icmp any any”  
“access-list 100 permit tcp xxx.xxx.xxx.xxx 0.0.0.31 any eq telnet”  
“access-list 100 permit tcp xxx.xxx.xxx.xxx 0.0.0.31 any eq telnet”  
“access-list 100 permit tcp xxx.xxx.xxx.xxx 0.0.0.31 any eq telnet”  
“access-list 100 permit tcp xxx.xxx.xxx.xxx 0.0.0.3 any eq telnet”  
“access-list 100 permit tcp xxx.xxx.xxx.xxx 0.0.0.3 any eq telnet”  
“access-list 100 permit tcp xxx.xxx.xxx.xxx 0.0.0.3 any eq telnet”  
“access-list 100 permit eigrp any any”  
“access-list 100 permit tcp any any established”  
“end”
```

- 7) Attach the access list to your serial interface's inbound.

```
Type:  
“conf t”  
“int s0”  
“ip access-group 100 in”  
“end”
```

- 8) Test your configuration.
9) Remove all configurations from your router.
10) Reboot your router.

All configs should have been removed.

LAB 8

Putting it all together

In this lab, we will:

- Configure your router using what you have learned in the previous labs.

Overview of steps

You will demonstrate the use of the commands you have used in the previous labs.

Equipment

Windows NT 4.0 server and terminal emulator
Un-configured Cisco router

Complete the following using the IP spread sheet and network diagram:

- 1) Set the hostname for your router.
- 2) Set the console password.

Make all passwords "password".

*******The password is case sensitive, so be careful.*******

- 3) Set the virtual line password.
- 4) Set the enable secret password.
- 5) Encrypt your passwords.
- 6) Configure a warning banner that will be displayed upon login.
- 7) Configure serial interfaces per network diagram and spread sheet.
- 8) If you have a DCE cable configure your clock to 4000000.
- 9) Configure ethernet interfaces per network diagram and spread sheet.
- 10) Add a description to all configured interfaces.
- 11) Enable all configured interfaces.
- 12) Configure a default route.
- 13) Configure EIGRP as your routing protocol using autonomous system 10.
- 14) Advertise all connected networks.
- 15) Configure your logging size to 4096.
- 16) Configure your logging and debug to display the date and time.